



Wearable Archives:
An Exploration of the Potential Impact of Wearable Computing Technologies on Digital Archiving and Preservation

Just now



Lizzy Rolando,
Research Data Librarian
and
Wendy Hagenmaier,
Digital Collections Archivist

Georgia Tech Library & Archives

Just now

About Our Exploratory Study

- Semi-structured **interviews** with **nine** early adopters of wearable computing technologies at Georgia Tech
- **Devices** used by respondents and number of users:



Fitbit: **6** Google Glass: **6**

Smartphone
& apps: **4**



Pebble & other
smartwatches: **4**

Custom heads-up
prototype device: **1**



GoPro: **1**



Wahoo Fitness
strap: **1**



Accelerometer &
electrodermal activity
monitor: **1**

Definition of Wearable Technology

Wear your Fitbit. It auto-tracks calories burned, steps, distance & sleep quality.

Fitness and sleep data is wirelessly uploaded to Fitbit.com.

Login **free** to Fitbit.com. See data, set goals, log food intake and compete with friends.

Just now



Definition of Wearable Technology

- hardware (physical device) itself
- software used with device
- combo of hardware & software
- used primarily to collect or create data
- used primarily to view or access data
- used for a combo of collect/create and view/access (most common)

Wearable Data

- Data from all aspects of life (work, home) are increasingly intermingled
- Data contain more physiological, location, and A/V information than typical personal archives
- New research questions are made possible via constant collection of new data types
- Quantity of data gathered and stored increases
- Privacy concerns become more complex
- The challenge of extracting meaning from data increases

Themes from Interviews

- Device/technology is worn on the body (6 respondents)
- Used daily and/or constantly, even 24/7 (5)
- File formats and data types are not transparent (5)
- Cell phones can be wearable tech (3)
- Wearable tech as active agent: anticipates user's behavior based on past patterns (3)
- Includes processing or compute abilities (3)
- This is kind of old news; wearable technology has been around for decades (2)
- Helps people with something (2)
- Wireless transfer of data (1)

Daily Use of Wearable Tech

Just now

GLASS



Relationship with Wearable Tech

- Quick access to information (6)
- Used for daily, everyday activities (6)
- Record information/data (4)
- Use is different depending on whether it's for research or daily life (2)
- Not mission critical (2)
- Difficult to remember to use it (2)
- Love-hate (1)

File Formats & Content Types

- Record and track activity, including location history (7)
- Record video or pictures (4)
- Receive email, texts, or other alerts (4)
- Jpeg (3)
- Mp4 (3)
- Excel (2)
- Csv (2)
- Text (3)
- No format or format not known because it's in the cloud (2)
- Record text notes (1)
- JSON (1)
- Avi (1)
- Mov (1)
- Evernote voice memo (1)

Software Tools & Usage

- Respondent moves data from one app/device to another (either because that's a feature of the device or because ants to combine data) (8)
- Device-specific application (5)
- Web application made by technology provider (5)
- Custom scripts or tool, created by user (4)
- 3rd party software tool (1)

Device Shortcomings

- Poor battery life (7)
- Physical design makes device socially awkward (4)
- Difficult to extract useful information from data (4)
- Device not completely immune to user error (can be lost, not waterproof, forget to wear it, etc.) (4)
- Limitations of software or application options (3)
- Difficult text entry/note creation (2)
- Imperfect motion controls (1)
- Connectivity problems (1)

Referring Back to Data Created With Wearable Tech

Just now

Refer Back: When

- Daily (usually a one-time daily review/share and then doesn't refer back to that data again) (5)
- Monthly (3)
- Rarely (2)
- Depends on type of data (2)
- One time (2)
- Weekly (1)

Refer Back: Why

- When sharing an item (3)
- Currently, data are limited in their usefulness because of lack of interoperability and because we don't know what they're useful for (2)
- When the respondent has a question (2)
- When making future plans (1)

Refer Back: How

- Uses visualization to find data (3)
- Does not use search to find data (3)
- Uses chronology to find data (browses by date) (2)
- Looks for patterns and trends (2)
- Examines tabular data (1)
- Using subject/topic to navigate or categorize data is still too hard b/c computer can't yet categorize things automatically (1)
- Queries/searches data (1)
- Wants to create an AI from data, which could be queried/searched (1)



Long-term Value of Wearable Data and Devices

Just now

LOKAL

Appraisal & Retention Plans

- Plans to keep data forever/ininitely (6)
- Will delete obviously accidental and/or poor data (4)
- Plans to store everything (3)
- If companies disappear, you may lose your data (2)
- Sees future use in all data (2)
- Data aren't important enough to worry about whether they are saved or lost (2)
- Since the data are not the end goal (behavioral modification is), it's not necessary to keep the data long-term (2)
- Uses metadata to help guide later decisions about what to keep (1)
- Storage is infinite (1)
- Design of services makes it difficult to delete data (1)
- Doesn't see future use in data, but keeps it anyway (1)

Backup Method & Frequency

- Makes a concerted effort to back up data (4)
- Makes no effort to back up data (3)
- Relies on “back up” in Google (3)
- Backs up on home network (3)
- Backs up on laptop (2)
- Backs up to Dropbox (2)
- Backs up every 2 months (1)
- Backs up once a year (1)
- Device itself is primary storage location; backs up to external device infrequently (1)

Value of Data to Respondent

- For sharing (and sometimes competition) (5)
- Because data capture and reinforce memories (5)
- For research (4)
- For monitoring my health (2)
- For as yet unknown reasons (3)
- Because data enables me to reflect on the past, present, and future (2)
- For monitoring progress and improving (1)
- Because I am in control of the data (1)

Value of Data to Others

- For research (4)
- Because data enable shared/vicarious experiences (4)
- For public health (3)
- For as yet unknown reasons (potentially valuable) (3)
- For marketing (2)
- For security (government) (1)
- Because data enable others to reflect on the past, present, and future (1)
- Because data enable others to reuse knowledge and resurrect expertise (1)

Digital Afterlife and Future Access

Just now



How Data Should Be Accessed in the Future

- It would be sufficient to access the data through another device, rather than the original device (device is “disposable;” content is what matters) (8)
- Accessing the data in whatever way is standard in future would be fine; devices are transitory (5)
- Will be crucial to be able to access the data on future devices - data must be portable (2)
- Access via device designed to access data would be better (1)
- Devices may not last and have shortcomings (1)
- Maintaining significant properties of hardware won’t matter but maintaining significant properties/experience of the data in the software might matter (1)

Willing Data/Device to Future Generations

- Would be comfortable willing device/data to future generations (5)
- Thinks data would be valuable to future generations (4)
- Actively wants/intends to will device/data to future generations (3)
- Not sure data would be valuable to future generation (3)
- Not concerned about privacy of data (2)
- Wearable data would be even more valuable to future generations than more traditional/basic data types because wearable data document context and emotion (1)
- Thinks preserving the conclusions drawn from the data is more important than preserving the data (1)
- Sees willing of device data as one part of the larger issue of willing entire digital estate (1)
- Would want to pick and choose which data to share, based on utility and value to future generations (would weed out work data and keep personal/family data) (1)

Does Future Use Affect Current Use

- Yes (5)
- Maybe (2)
- If respondent didn't think they could use the data in the future, they wouldn't use device as much (1)
- Future promise of automated description for video leads respondent to take more videos now; future concerns about who will see data changes what respondent captures now (1)
- One factor that affects whether respondent will continue using a device is whether they can easily extract and share the data (1)
- Categorizes data so can use it in the future (1)
- Uses plain text only to ensure future flexibility and so data can be searched in future (1)

Donating Data/Device to Archives

- Comfortable donating data (sometimes with some restrictions) (7)
- Some privacy concerns (data should be anonymized or weeded) (3)
- Depends on the purpose of the donation and what it would be used for (2)
- Device is not worth donating (2)
- Device might be valuable to people in the future (2)
- Depends on the institution (1)
- Not sure data would be valuable to donate (1)
- Would only want to donate data about particular topic (technology and wearable computing) (1)

Ownership of and Access to Wearable Data

Just now



Who Owns the Data

- Not sure who owns the data/gray area (3)
- Respondent owns (3)
- Respondent should own the data but understands that companies also do (2)
- Company owns the data (2)
- No one owns (no one truly owns their data when everything is on the record, policies change, and anyone could have access) (1)

Who Has Access to the Data

- Respondent knows that respondent and company both have access but isn't sure who else does (4)
- The answer to this question and this issue of access will matter more in the future or should change (3)
- Party/parties the respondent has granted access to (friends, IRB co-investigators, etc.) (2)
- Other companies (2)
- Depends on the policies of the company (2)
- Respondent and the company (1)

Thoughts on Ownership & Access

- Disconnect between the answer respondent wishes it were and the answer it actually is (3)
- Pays attention to terms of service and privacy policies (3)
- Doesn't read terms of service and privacy policies closely (2)
- Not particularly concerned about privacy (2)

Definition of Archives

Just now

INDUSTRIAL, MILITARY
& MEDICAL SYSTEMS

1. Triplett VisualEYEzer 3250

\$500 | 2000

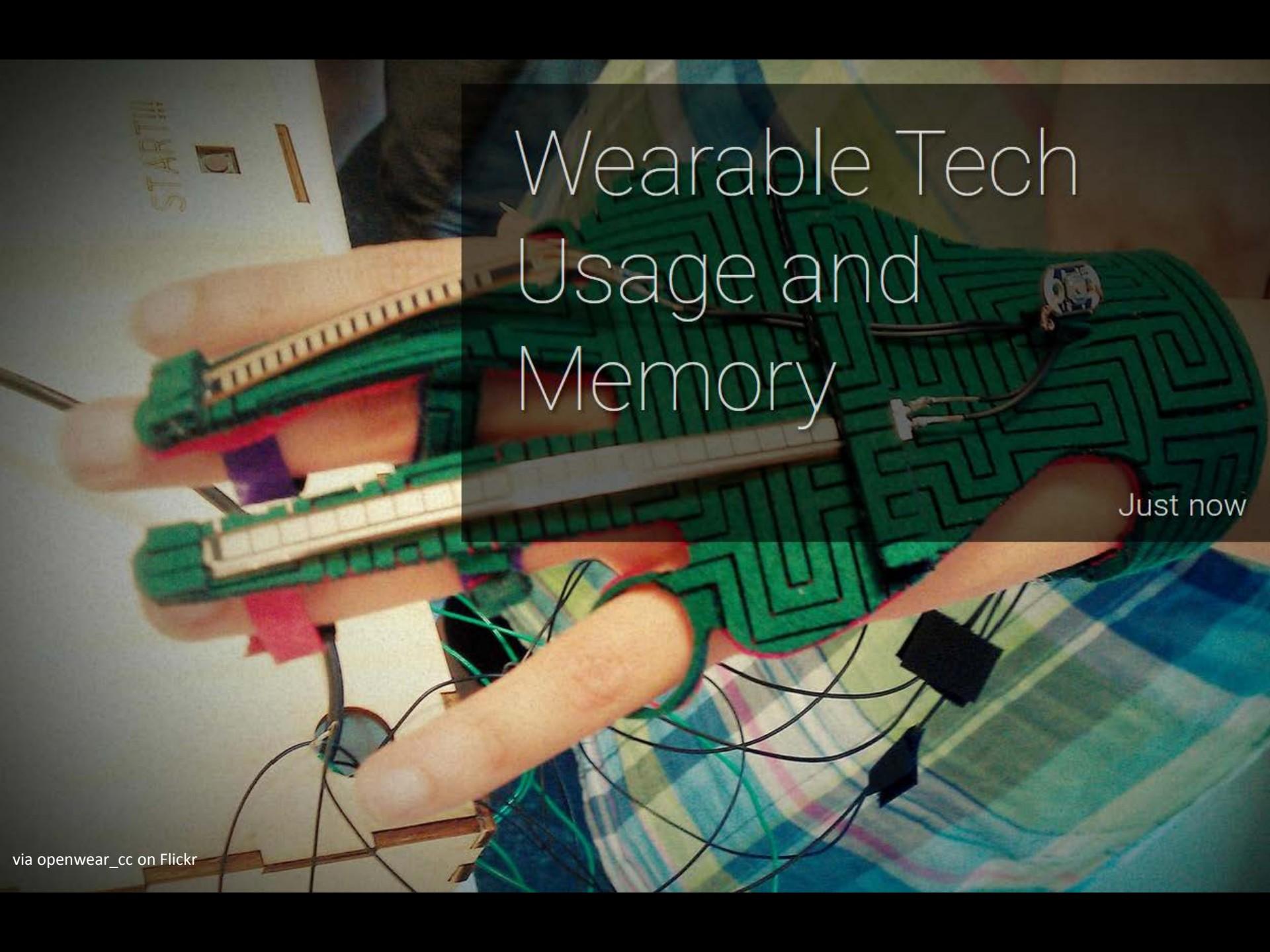
The VisualEYEzer is an example of a special-purpose head-up display. A worker can use a hand for each of the two probes while touching them to a circuit and glance up at the segmented LED display for a reading.

Definition of “Archives”

- Place to store stuff that you want to find later, has a mechanism to help you find stuff and is organized (4)
- Place to store important stuff (not just storage; storage for something you care about/don't want to lose) (3)
- Intentionally/actively created and controlled (vs. “backup,” which is seen as passive data collection) (3)
- Kept for a certain amount of time (timeframe has implications for privacy, anonymity, user comfort level, value) (3)
- Documents that stand the test of time/that you want to save (2)
- Contains everything and used like a brain (2)
- Organized and navigated by human-created structure (folders) (2)
- Organized and navigated by automated means (search) (2)
- Collection of data from the past (2)
- Export of data (1)

Do You Have an Archive

- Yes (6)
 - Both physical and digital (2)
 - Digital only (1)
- No (2)
 - Has backup; not an archive (1)
 - Has a collection of stuff but it's not organized, so it's not an archive (1)

A collage of images illustrating wearable technology and memory. The top left image shows a close-up of a person's arm wearing a green and white woven bracelet with a small electronic component attached. The top right image is a graphic of a hand holding a green maze with a small electronic device on it, overlaid with the text "Wearable Tech Usage and Memory". The bottom image shows a person's arm wearing a colorful, patterned bracelet with multiple wires and sensors attached, representing complex wearable technology.

Wearable Tech Usage and Memory

Just now

Relationship Between Wearable Tech Usage & Memory

- Device makes it easier to create/document/store memories (3)
- Device makes it easier to recall/trigger memories (3)
- Device makes ability to remember less necessary/unnecessary (3)
- Device enables respondent to reflect (3)
- Device enhances memory (3)
- Device is a temporary memory aid (2)
- Device enables respondent to focus less on rote memorization and more on complex processing of information (2)
- Device enables searching through memory/memories (2)
- Device quantifies memory (2)
- Device impacts short-term and long-term memory (1)
- Device has its own memory (computer definition of memory), and memory capacity is improving (1)
- Device has everything to do with memory (1)



Narrative

Narrative Clip

A tiny, automatic camera and app that gives you a searchable and shareable photographic memory.



Starting Points for Curators and Further Research

\$279

Buy Just now

Give as gift

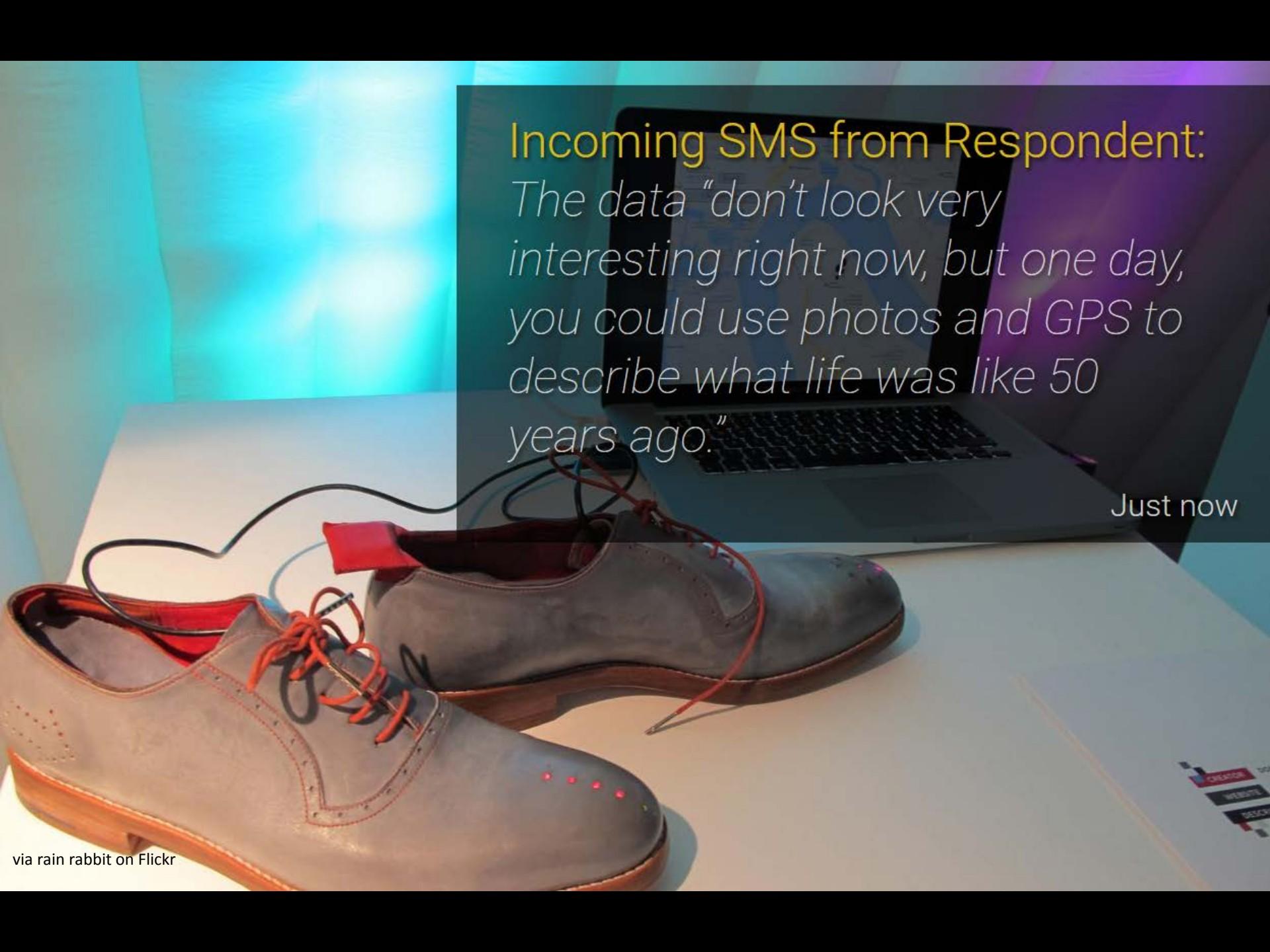
Give the gift of everlasting memories!

Choose your color:

White Gray Orange

Let's Find Out:

- What data wearable archive creators are making (intentionally, passively, even involuntarily), how big the data is, and why they want to keep the data forever
- Whether “wearableness” makes the data different from other big data, in terms of preservation and access
- When we should acquire these data, and how they'll fit into the context of the whole archive
- How the fact that users are licensing their data to corporations from the start might affect their attitudes about access, ownership, privacy, and donating to archives
- How creators, archivists, and researchers can extract meaning from wearable archives, with current and future tools
- The implications of creators and software mining personal digital archives constantly: the archive in real time
- How wearable tech will continue to affect memory, at an individual and cultural level



Incoming SMS from Respondent:
The data “don’t look very interesting right now, but one day, you could use photos and GPS to describe what life was like 50 years ago.”

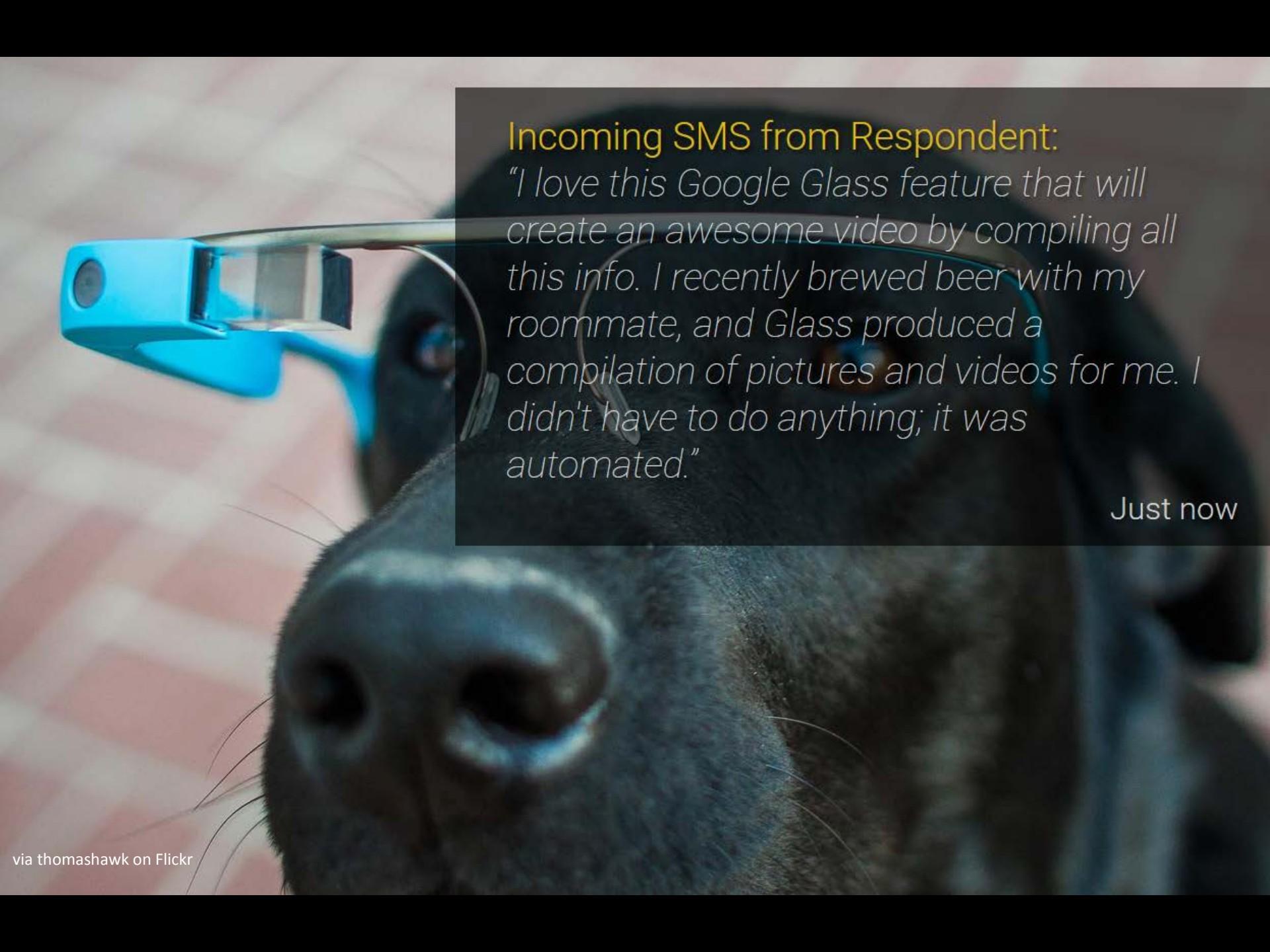
Just now

I need a better
BUILD YOUR OWN WEARABLE TECHNOLOGY

Incoming SMS from Respondent:
If you "compile the data from the devices on a daily basis and you have this giant collection of stuff, would it be more productive to extract value and meaning and then throw away the data?"

Just now





Incoming SMS from Respondent:

"I love this Google Glass feature that will create an awesome video by compiling all this info. I recently brewed beer with my roommate, and Glass produced a compilation of pictures and videos for me. I didn't have to do anything; it was automated."

Just now

Activity

Steps

16000
14000
12000
10000
8000
6000
4000
2000

May 01

May 07

May 13

May 19

May

Incoming SMS from Respondent:

"There's a lack of tools that allow you to aggregate data and figure out how to extract meaning outside of just the numbers. What do these things actually mean?"

3,000 steps from Fitbit just means 3,000 steps, but it may really mean that you got coffee in the morning or took your daughter for a walk in her stroller."

Just now

A photograph showing a close-up of a person's arm and torso. The person is wearing several smartwatches on their wrists and a black belt with various sensors and a small screen attached to it. The background is dark.

Incoming SMS from Respondent:

"Can I make an artificial intelligence that people could ask questions of, and it would refer back to my database and answer the question in a similar way to how I would?"

• You could imagine Siri or something like it, which would actually have my knowledge and then people could query my knowledge.

The whole idea is to archive my life; to build a system to emulate me and help others directly."

Just now

Ideas for Further Research

- Comparing perceptions of early adopters with those of later, more **typical users**
- Comparing record types created with **different devices** (for example, electronic clothing vs. smartwatches)
- Conducting a **case study** of accessioning records created using wearable devices
- Researching whether and how wearable device manufacturers and telecommunications **providers** consider the preservation needs of customers and digital curators, in design and storage
- Exploring developments in embedded, **in-body** wearable devices
- Studying **correlations** between wearable data streams (for example, heart rate data and text message data)
- Considering how to create the **access points** needed for big wearable data

Detailed Slides & Contact Info

- Link to complete *slides* for more detail:

<http://bit.ly/wearablearchives>

- Feel free to *get in touch* with questions and ideas!

wendy.hagenmaier@library.gatech.edu

lizzy.rolando@library.gatech.edu